

**COORDINATION AND SELECTION OF
MV AND LV FUSES FOR
DISTRIBUTION TRANSFORMER PROTECTION**

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University of Moratuwa, Sri Lanka.
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Department of Electrical Engineering

University of Moratuwa

Sri Lanka

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Dissertation submitted in partial fulfillment of the requirements for the degree of
Master of Science

Department of Electrical Engineering

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DECLARATION

The work submitted in this dissertation is the result of my own investigation, except where otherwise stated.

It has not already been accepted for any degree, and is also not being concurrently submitted for any other degree.

D.D.K.G. Sandasiri

Date: 15th March 2013

I endorse the declaration by the candidate.



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Senior Professor

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ABSTRACT

The Ceylon Electricity Board (CEB) has the responsibility of distributing electricity to the consumers in Sri Lanka except few areas which belong to the Lanka Electric Company (LECO). When considering about the distribution network, distribution transformers play the major role. Protection of transformers is therefore very much important. Transformer failure rate and the distribution network reliability are major concerns of the CEB. Distribution transformer failure rate is high in the CEB network and also the fuse usage is unacceptably high.

Present CEB fuse selection practice and practical situation at the field have been analyzed to find out better solution for above problems. Theory behind distribution transformer fuse selection has been discussed in detail. K type expulsion fuses are the recommended primary side fuses by the CEB. The study has proposed several changes to the existing fuse selection practice recommended by the CEB.

The present distribution transformer protection scheme do not provide over load protection. It has been identified that nearly 13% transformers had failed annually due to over load within the Southern Province. The study revealed that lower capacity of transformers such as 100kVA and 160kVA have the higher probability of getting overloaded. Furthermore, 15% of distribution transformers installed in the Southern Province have at least one phase overloaded.

A Primary side K type fuse does not provide overload protection to the distribution transformer. Hence, secondary side fuse should provide the over load protection but above findings tell that the expected task cannot be achieved by the present system. The study has proposed three options to solve this problem. Introduction of a primary fuse which is having special Time Current Characteristic (TCC) curve is the first option. The fuse type is called "SloFast" and it has a dual TCC curve. The SloFast fuse TCC curve behaves very much parallel to the transformer damage curve at some low level of current unlike K type fuse TCC curve, which intersects transformer damage curve at some low level of current.

The second option is adding a main secondary fuse in between the transformer secondary terminal and the feeder fuses. So that the feeder fuse does the overload

protection of the feeder conductor and the main secondary fuse does the overload protection of distribution transformer.

The third option is limitation of the number of outgoing feeders from a transformer. This is very important for the distribution transformers having low capacities such as 100kVA and 160kVA, because the probability of getting overloaded is high with the present feeder arrangement. It is recommended the maximum number of feeders for each distribution transformer capacity.



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TABLE OF CONTENTS

Declaration	i
Abstract	ii
Acknowledgement	iv
List of Figures	vii
List of Tables	ix
List of Abbreviations	x
1. Introduction	1
1.1 Background	1
1.2 Motivation	2
1.3 Scope of work	2
2. Problem Statement	3
3. Theoretical Development	3
3.1 Distribution Transformer	6
3.2 Fuse Protection	7
3.2.1 DDLQ type Expulsion fuse	9
3.2.2 Current Limiting Fuses	10
3.3 Distribution Transformer Protection	12
3.3.1 Factors to be considered when selecting the primary fuse	12
3.3.2 Transformer Inrush current	14
3.3.3 Inrush points for a 33kV 160kVA transformer	17
3.4 Tranformer Damage Curve	17
4. Fuse Selection and Coordination	21
4.1 Distribution transformer over current protection	21
4.2 Distribution transformer primary side protection	21
4.3 Comparison of selcted MV fuse ratings with CEB specified fuse ratings	23
4.4 Secondary side fuse selection and coordination	27
4.4.1 Current CEB practice	27
4.4.2 Coordination with 160A fuse	28

4.4.3 Drawbacks of LV fuse selection practice	32
4.5 Transformer failures due to overload	34
4.6 Option 1: Over load protection using MV fuse	35
4.6.1 SloFast fuse link	37
4.6.2 SloFast fuse selection	39
4.7 Option 2: Main LV side fuse per phase	43
4.8 Option 3: Limitation of number of outgoing feeders	46
4.9 Advantages of proposed MV and LV fuse selections	47
5. Conclusion and Recommendations	48
5.1 Conclusion	48
5.2 Recommendation	48
5.2.1 Improvements to the present fuse selection practice	48
5.2.2 Overload protection	49
Reference List	50
Annex 1: K type fuse selection	52
Annex 2: SloFast fuse selection	63
Annex 3:  100kVA transformer load reading in Ambalangoda	73
Annex 4:  160kVA transformer load reading in Ambalangoda	78

LIST OF FIGURES

	Page
Figure 3.1 Pole mounted distribution transformer	6
Figure 3.2 Typical arrangement of distribution substation	7
Figure 3.3 Time Current Characteristic Curves	8
Figure 3.4 DDLO Switch	9
Figure 3.5 Current and Voltage Waveforms for an Expulsion Fuse Operation	10
Figure 3.6 HRC fuses	11
Figure 3.7 Current and Voltage Waveforms for a Current Limiting Fuse	12
Figure 3.8 Magnetizing inrush current	15
Figure 3.9 Damage and Inrush Curves for 33kV 160kVA transformer	20
Figure 4.1 Fuse characteristic curves with 160kVA 33/0.4kV transformer damage curve and inrush curve	22
Figure 4.2 33kV 630kVA transformer damage curve and inrush curve with 12A and 20A fuse TCC	25
Figure 4.3 Fuse switch disconnecter	27
Figure 4.4 TCC curves for 3A MV fuse and 160A LV fuse with 100kVA 33/0.4kV transformer curves	29
Figure 4.5 LV fuse options for 100kVA 33kV transformer	30
Figure 4.6 160kVA 33/0.4kV transformer curves with selected MV and LV fuse TCC curves	31
Figure 4.7 Unprotected region of transformer by MV fuse	36
Figure 4.8 Time Current Characteristic Curve for a SloFastfuse	37
Figure 4.9 Inner construction of a SloFast fuse	38
Figure 4.10 250kVA 33/0.4kV transformer curves with 4.2A SloFast fuse TCC curve	39
Figure 4.11 250kVA 33/0.4kV transformer with SloFast fuse TCC curves of 2.1A, 3.1A & 3.5A	40
Figure 4.12 TCC curve for 100kVA 33/0.4kV transformer with 1.3A rated SloFast Fuse	41

Figure 4.13	Distribution substation arrangement for option-2	42
Figure 4.14	315A Main secondary fuse TCC for 33kV 160kVA transformer	44



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LIST OF TABLES

	Page	
Table 2.1	Number of transformers installed in Southern province at the end of 2010	3
Table 2.2	MV fuse usage from January to August in year 2010	3
Table 2.3	Transformer failures in Southern province form 2008 to 2010	4
Table 3.1	Current limiting fuses used by CEB	11
Table 3.2	Categories of through fault protection curves	18
Table 3.3	Damage curve for Category I& Category II liquid immersed transformer	18
Table 3.4	Relationship between Per-Unit Primary Side Line Current and Per-Unit Transformer Winding Current	19
Table 4.1	Comparison of selected fuse ratings with CEB specified values for 33kV	23
Table 4.2	Comparison of selected fuse ratings with CEB specified values for 11kV	24
Table 4.3	Fusing ratios for 33kV transformer fuse selection	26
Table 4.4	Fusing ratios for 11kV transformer fuse selection	26
Table 4.5	LV fuse selection	32
Table 4.6	Examples for transformers having one phase overloaded	33
Table 4.7	Transformer failures due to overload	34
Table 4.8	SloFast fuse ratings for each transformer rating	42
Table 4.9	Fuse ratings for main secondary fuses	45
Table 4.10	LV feeder limitation	45
Table 4.11	Annual cost of transformers failed due to over loading	46

LIST OF ABBREVIATIONS

Abbreviation	Description
CEB	Ceylon Electricity Board
IEEE	Institute of Electrical and Electronic Engineers
MV	Medium Voltage
LV	Low Voltage
DDLO	Drop Down Lift Off
HRC	High Rupturing Capacity
MCCB	Molded Case Circuit Breaker
TCC	Time Current Characteristic



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